
Healing of extraction sockets and surgically produced – augmented and non-augmented – defects in the alveolar ridge. An experimental study in the dog

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J Clin Periodontol 2005; 32: 435–440

Objectives: The current experiments had three aims (i) to determine whether the absence of the periodontal ligament (PDL) may alter features of the healing of an extraction socket, (ii) to examine if there were differences in the proportion of different tissues in resolved extraction sockets and surgically produced defects after 3 months of healing, (iii) to study the influence of different biomaterials on the healing of surgically produced bone defects.

Material and Methods: Extraction sites: In five dogs, the 4th mandibular pre-molars were hemi-sected and the distal roots were removed. The extraction socket of one of the pre-molars was instrumented to eliminate all remnants of the PDL tissue. The socket of the contra-lateral pre-molar was left without instrumentation. The dogs were sacrificed after 3 months of healing.

Defect sites: In five dogs, the pre-molars and 1st molars on both sides of the mandible were first removed and 3 months of healing allowed. After this interval three standardized cylindrical defects were prepared in each side of the mandible. The defects were 3.5mm in diameter and 8mm deep.

In each quadrant one defect was grafted with Bio-Oss Collagen, one with Collagen Sponge and one defect was left non-grafted. The dogs were sacrificed 3 months after the grafting procedure.

Results: Extraction sites: The two categories of extraction sockets did not differ with respect to gross morphological features. The tissue of the extraction sites, apical of a newly formed bone bridge, was dominated by bone marrow. Few trabeculae of lamellar bone were also present.

Defect sites: The non-augmented defect was sealed by a hard-tissue bridge. In the central and apical portions of the defect bone marrow made up about 61%, and mineralized bone 39% of the tissues. The invagination of the surface of this crestal bone was 0.8 ± 0.3 mm.

The defect augmented with Collagen Sponge was covered by a hard-tissue bridge 38% of the tissue within the defect was made up of bone marrow while the remaining 62% was occupied by mineralized bone. The invagination of the hard-tissue bridge was on the average 0.6 ± 0.1 mm.

In defects augmented with Bio-Oss Collagen the biomaterial occupied a substantial portion of the tissue volume. Eighty-five percent of the periphery of the Bio-Oss particles were found to be in direct contact with newly formed mineralized bone. Woven bone and bone marrow made up 47% and 26% of the newly formed tissue. The invagination of the most coronal part of the bone defect was 0.1 – 0.1 mm.

Conclusion: Sockets that following tooth removal had their PDL tissue removed exhibited similar features of healing after 3 months as sockets which had the PDL retained. The tissues present in an extraction site appeared to be more mature than those present in a surgically produced defect of similar dimension. The Bio-Oss Collagen augmented defect exhibited less wound shrinkage than the non-augmented defect.

- ➔ Hier wird angegeben, dass Extraktionsalveolen ähnlich abheilen unabhängig davon, ob das parodontale Ligament entfernt wird oder nicht.

Consensus Report

Tissue augmentation and esthetics

(Working Group 3)

B. Klinge, Thomas F. Flemmig

Clin. Oral Impl. Res. 20 (Suppl. 4), 2009; 166–170.

Abstract

Introduction: The remit of this working group was to update the existing knowledge base regarding bone augmentation for implant site development and soft-tissue grafting for esthetic outcomes. Four reviews from the working group formed the basis of this update. Moreover, clinical applications as well as suggestions for further research have been formulated.

Materials and methods: The papers in the working group critically reviewed the literature. Four manuscripts were produced assessing (a) the outcomes of correcting dehiscence and fenestration defects at implant sites using various graft materials, (b) the outcomes of sinus floor augmentation at maxillary posterior sites with 6mm or less residual bone height using various graft materials, (c) the association of the horizontal dimensions of buccal and interproximal bone with esthetic outcomes of implant-supported restorations, and (d) the outcomes of soft-tissue augmentations.

Results: The results and conclusions of the review process are presented in the following papers. The group's consensus statements, clinical implications, and directions for future research are presented in this article.

- ➔ Hier wird angegeben, dass die Techniken der Parodontalchirurgie bezüglich Volumen und Weite von Weichgewebe an Zähnen auch auf Implantate übertragen und angepasst werden können. Es seien keine Langzeitergebnisse bei Zähnen und

Implantaten vorhanden. Es können keine Angaben zu idealen Materialien gemacht werden.

Ridge preservation with the use of Bio-Osss collagen: A 6-month study in the dog

Mauricio G. Araujo, Jan Lindhe

Clin. Oral Impl. Res. 20, 2009; 433–440

Abstract

Background: In previous short-term studies, it was observed that while the placement of biomaterial in alveolar sockets may promote bone formation and ridge preservation, the graft may in fact also delay healing.

Aim: The objective of the present experiment was to evaluate the more long-term effect on hard tissue formation and the amount of ridge augmentation that can occur by the placement of a xenogeneic graft in extraction sockets of dogs.

Material and methods: Five beagle dogs were used. The third mandibular premolars were hemi-sectioned. The distal roots were carefully removed. A graft consisting of Bio-Osss collagen was placed in one socket while the contra-lateral site was left without grafting. After 6 months of healing, the dogs were euthanized and biopsies were sampled. From each experimental site, four ground sections – two from the mesial root and two from the healed socket – were prepared, stained and examined under a microscope.

Results: The placement of Bio-Oss collagen in the fresh extraction socket served as a scaffold for tissue modeling but did not enhance new bone formation. In comparison with the non-grafted sites, the dimension of the alveolar process as well as the profile of the ridge was better preserved in Bio-Osss-grafted sites.

Conclusion: The placement of a biomaterial in an extraction socket may modify modeling and counteract marginal ridge contraction that occurs following tooth removal.

- ➔ Eine 6-Monats-Studie, welche nach dieser Zeit zu dem Schluss kommt, dass die Verwendung von BioOss Collagen die marginale Breite des Alveolarkamms nach Zahnextraktion erhalten könnte.
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Dimensional changes of the alveolar ridge contour after different socket preservation techniques

Stefan Fickl, Otto Zuhr, Hannes Wachtel, Christian F. J. Stappert, Jamal M. Stein and Markus B. Hürzeler

J Clin Periodontol 2008; 35: 906–913

Abstract

Objectives: The aim of the following study was to assess contour changes after socket preservation techniques.

Material and Methods: In five beagle dogs, the distal root of the third and fourth mandibular premolars was extracted. The following treatments (Tx) were randomly assigned for the extraction socket.

Tx 1: BioOss Collagen.

Tx 2: BioOss Collagen and a free soft tissue graft.

Tx 3: No treatment.

Tx 4: The internal buccal aspect was covered with an experimental collagen membrane, the extraction socket was filled with BioOss Collagen and the membrane folded on top of the graft. Impressions were obtained at baseline, 2 and 4 months after surgery. Bucco-lingual measurements were performed using digital imaging analysis.

Results: All groups displayed contour shrinkage at the buccal aspect. Only the differences between the two test groups (Tx 1, Tx 2) and the control group (Tx 3) were significant at the buccal aspect ($p < 0.001$). No measurements of the Tx 4 group could be performed.

Conclusion: Socket preservation techniques, used in the present experiment, were not able to entirely compensate for the alterations after tooth extraction. Yet, incorporation of BioOss Collagen seems to have the potential to limit but not avoid the postoperative contour shrinkage.

- ➔ Hier wird das Potenzial von Techniken zur Alveolen Behandlung nach Extraktion beschrieben, wobei eine komplette Erhaltung der Kammbreite nicht möglich schien. Es wird darauf hingewiesen, dass weitere Forschung bezüglich Weichgewebstransplantaten zum Erhalt des Alveolarkamms betrieben werden sollte.
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Intrasocket Reactive Soft Tissue for Primary Closure After Augmentation of Extraction Sites With Severe Bone Loss Before Implant Placement

Ofer Mardinger, Gavriel Chaushu, Oded Ghelfan and Joseph Nissan

J Oral Maxillofac Surg 67:1294-1299, 2009

Purpose: The normal bone resorption after tooth extraction can be significantly aggravated in the case of pre-existing severe bone loss and chronic infection. Bone augmentation procedures have been proposed, but they require adequate closure of soft tissues. We propose the use of intrasocket reactive tissue to cover extraction sites augmented by bovine bone mineral graft to promote the success of the graft procedure.

Patients and Methods: The study included 24 patients with severe bone loss and chronic pathology in 27 sites. The intrasocket reactive soft tissue was elevated from the bony walls in a subperiosteal plane. Porous bovine or allograft bone mineral was placed in the extraction site without membranes, and the intrasocket reactive soft tissue was sutured over the grafting material to seal the coronal portion of the socket. Twenty-seven implants were placed 6 months after bone augmentation.

Results: Healing progressed uneventfully. Postoperative morbidity was minimal. There was no leakage or infection of the grafting material. The mean time to implant placement was 7.8 months. Supplemental augmentation was not needed. There were no implant failures. Follow-up ranged from 6 to 36 months (mean, 15 months). All implants were rehabilitated with fixed prostheses.

Conclusions: Intrasocket reactive soft tissue can be used predictably to obtain primary closure of augmented extraction sites with severe bone loss with minimal postoperative morbidity.

- Die Autoren verwendeten entzündlich-reaktives Weichgewebe entnommen aus Alveolen von extrahierten Zähnen, um mit diesem dann die mit BioOss gefüllte Alveole wieder zu verschließen. Später wurden dann Implantate in dieses Areal gesetzt.

Ridge alterations following tooth extraction with and without flap elevation: an experimental study in the dog

Mauricio G. Araujo, Jan Lindhe

Clin. Oral Impl. Res. 20, 2009; 545–549.

Abstract

Background: Different approaches were advocated to preserve or improve the dimension

and contour of the ridge following tooth extraction. In some of studies, socket 'flapless extraction' apparently had a successful outcome.

Aim: The objective of the present experiment was to compare hard tissue healing following tooth extraction with or without the prior elevation of mucosal full-thickness flaps.

Material and methods: Five mongrel dogs were used. The two second mandibular premolars (2P2) were hemi-sected. The mesial roots were retained. By random selection the distal root in one side was removed after the elevation of full-thickness flaps while on the contralateral side, root extraction was performed in a flapless procedure. The soft tissue wound was closed with interrupted sutures. After 6 months of healing, the dogs were euthanized and biopsies were sampled. From each experimental site, four ground sections – two from the mesial root and two from the healed socket – were prepared, stained and examined in the microscope.

Results: The data showed that the removal of a single tooth (root) during healing caused a marked change in the edentulous ridge. In the apical and middle portions of the socket site minor dimensional alterations occurred while in the coronal portion of the ridge the reduction of the hard tissue volume was substantial. Similar amounts of hard tissue loss occurred during healing irrespective of the procedure used to remove the tooth was, i.e. flapless or following flap elevation.

Conclusion: Tooth loss (extraction) resulted in marked alterations of the ridge. The size of the alveolar process was reduced. The procedure used for tooth extraction – flapless or following flap elevation – apparently did not influence the more long-term outcome of healing.

- ➔ Hier wird im Gegensatz zu anderen Studien festgestellt, dass die Zahnextraktion mit Lappenbildung **nicht** unbedingt das Langzeitergebnis im Gegensatz zur einfachen Extraktion beeinflusst.

Modeling and remodeling of human extraction sockets

Trombelli L, Farina R, Marzola A, Bozzi L, Liljenberg B, Lindhe J

J Clin Periodontol 2008; 35: 630–639.

Abstract

Introduction: The available studies on extraction wound repair in humans are affected by significant limitations and have failed to evaluate tissue alterations occurring in all compartments of the hard tissue defect.

Aim: To monitor during a 6-month period the healing of human extraction sockets and include a semi-quantitative analysis of tissues and cell populations involved in various stages of the processes of modeling/remodeling.

Material and Methods: Twenty-seven biopsies, representative of the early (2–4 weeks, n510), intermediate (6–8 weeks, n56), and late phase (12–24 weeks, n511) of healing, were collected and analysed.

Results: Granulation tissue that was present in comparatively large amounts in the early healing phase of socket healing, was in the interval between the early and intermediate observation phase replaced with provisional matrix and woven bone. The density of vascular structures and macrophages slowly decreased from 2 to 4 weeks over time. The presence of osteoblasts peaked at 6–8 weeks and remained almost stable thereafter; a small number of osteoclasts were present in a few specimens at each observation interval.

Conclusions: The present findings demonstrated that great variability exists in man with respect to hard tissue formation within extraction sockets. Thus, whereas a provisional connective tissue consistently forms within the first weeks of healing, the interval during which mineralized bone is laid down is much less predictable.

- ➔ In diesem Artikel wird beschrieben, dass bei Menschen der Verknöcherungsvorgang nach Extraktionen interindividuell sehr heterogen ist, was eine Vorhersage zum richtigen Implantationszeitpunkt beeinflusst.

Comparison of procedures for immediate reconstruction of large osseous defects resulting from removal of a single tooth to prepare for insertion of an endosseous implant after healing

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Int. J. Oral Maxillofac. Surg. 2009; 38: 736–743

Abstract. This study evaluated the treatment outcome of immediate reconstruction of 45 large osseous defects resulting from removal of a single tooth with a 1:2 mixture of Bio-Oss1 and autologous tuberosity bone, and three different procedures for soft tissue closing (Bio-Gide1 membrane, connective tissue graft, full-thickness palatal mucosa graft; n = 15 per group). All defects had an unfavourable osseous–gingival relationship and vertical bone loss of >5 mm. The hard and soft tissues were immediately reconstructed after removal of the tooth. Implants were inserted after 3 months. Patients' acceptance, complications and postoperative morbidity were prospectively evaluated by standardized clinical and radiographic examinations up to 12 months after the augmentation procedure. The patients completed a questionnaire on subjective complaints related to the procedure. All hard–soft tissue procedures resulted in sufficient bone volume for the insertion of implants and a favourable aesthetic outcome. The gingival mid-buccal aesthetics before, and 1 year after, treatment significantly favoured the full-thickness palatal mucosa graft, showing a gain in gingival contour of 0.5 ± 0.8 mm; the other procedures resulted in a 1.2 ± 1.6 mm decrease. Of the procedures evaluated, a full-thickness palatal mucosa graft was the most predictable for immediate reconstruction of the socket after tooth removal.

- ➔ Die Autoren bevorzugen als Resultat die Auffüllung der Extraktionsalveole mit einem Gemisch aus autogenem Knochen und BioOss mit anschließender Abdeckung mit einem Transplantat aus palatinaler Mukosa zur Rekonstruktion des Alveolarkamms mit vorhersagbarem Ergebnis.

Die Extraktionsalveole als potenzielles Implantatbett

Biologische und therapeutische Aspekte

Michael Fröhlich

Zahnmedizin up2date 2009; 3(6): 555-576

- ➔ Leider kein Abstract vorhanden, aber ein interessanter Artikel.

Ridge preservation techniques for implant therapy.

Darby I, Chen ST, Buser D.

Int J Oral Maxillofac Implants. 2009; 24 Suppl:260-71.

Abstract

PURPOSE: The aim of this review was to evaluate the techniques and outcomes of postextraction ridge preservation and the efficacy of these procedures in relation to subsequent implant placement.

MATERIALS AND METHODS: A MEDLINE/PubMed search was conducted and the bibliographies of reviews from 1999 to March 2008 were assessed for appropriate studies. Randomized clinical trials, controlled clinical trials, and prospective/retrospective studies with a minimum of five patients were included.

RESULTS: A total of 135 abstracts were identified, from which 53 full-text articles were further examined, leading to 37 human studies that fulfilled the search criteria. Many different techniques, methodologies, durations, and materials were presented in the publications reviewed, making direct comparison difficult.

CONCLUSIONS: Despite the heterogeneity of the studies, it was concluded that ridge preservation procedures are effective in limiting horizontal and vertical ridge alterations in postextraction sites. There is no evidence to support the superiority of one technique over another. There is also no conclusive evidence that ridge preservation procedures improve the ability to place implants.

- ➔ In diesem Review (Teil der 4. ITI Consensus Conference) wird darauf hingewiesen, dass Ridge Preservation Techniken einen Nutzen zeigen, allerdings derzeit keine Aussage über die Überlegenheit einer bestimmten Technik gemacht werden kann.